



CLARREO IR Radiance Benchmark Product Analyses

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**University of Wisconsin-Madison,
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**CLARREO SDT Meeting
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17-19 May 2011**

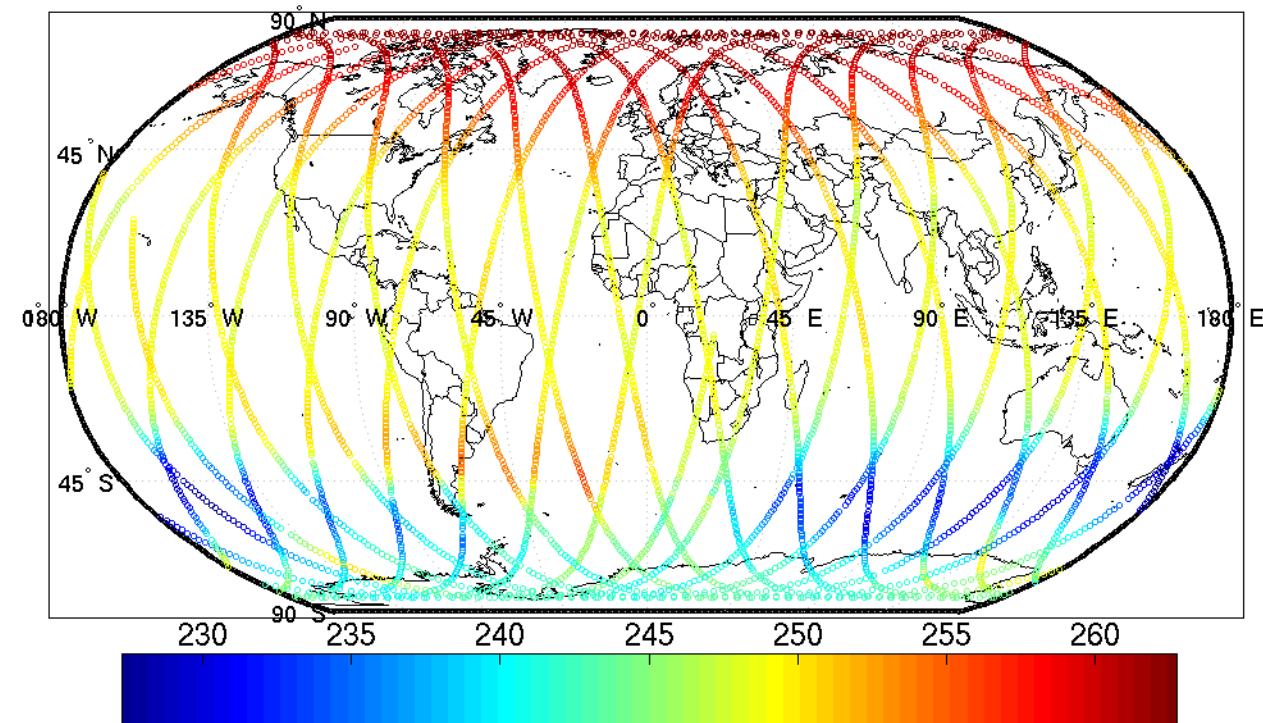


Topics

- 1. Refine Mission requirements using Observations**
- 2. Refine Measurement requirements using Observations**
- 3. Focus on Water Vapor Variability and Trends**

CLARREO IR Proxy Dataset

AIRS B.T. 667.8 cm⁻¹: FOV_100km_20030801.hdf



*UW Developed CLARREO Proxy Dataset derived from AIRS observations
(Nadir only, up to 100 km FOV diameter, continuous sampling)*

CLARREO IR Proxy Dataset

CLARREO from AIRS

Date range
(YYYYMMDD),
currently only 2006
available (optional)
Min: 20060101
Max: 20061231

Select Wavenumber
(rounded to closest value)
910

Solar Zenith angle limits
(optional)
Min:
Max:

FOV Diameter
13.5 km every 2.66 sec

Grid size in degrees
10x15

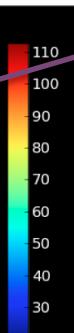
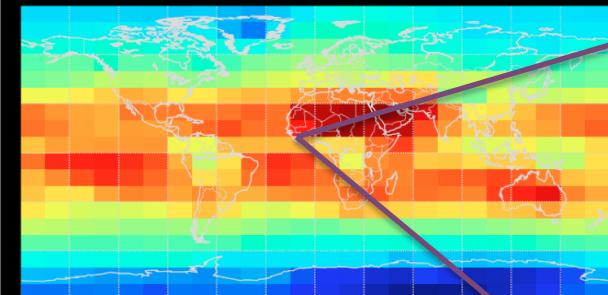
Plots to show:

AVG RAD
 STD RAD
 Num points

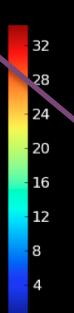
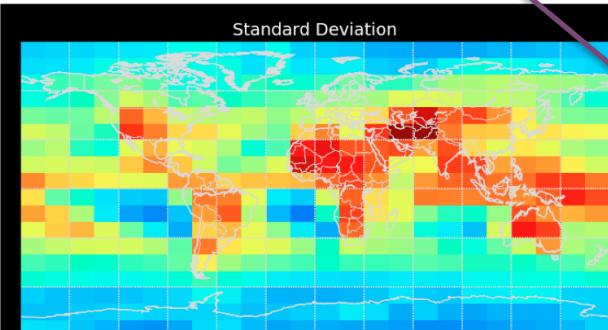
submit

node 10.255.255.215 took 28.17 seconds 60120
node 10.255.255.226 took 29.66 seconds 0

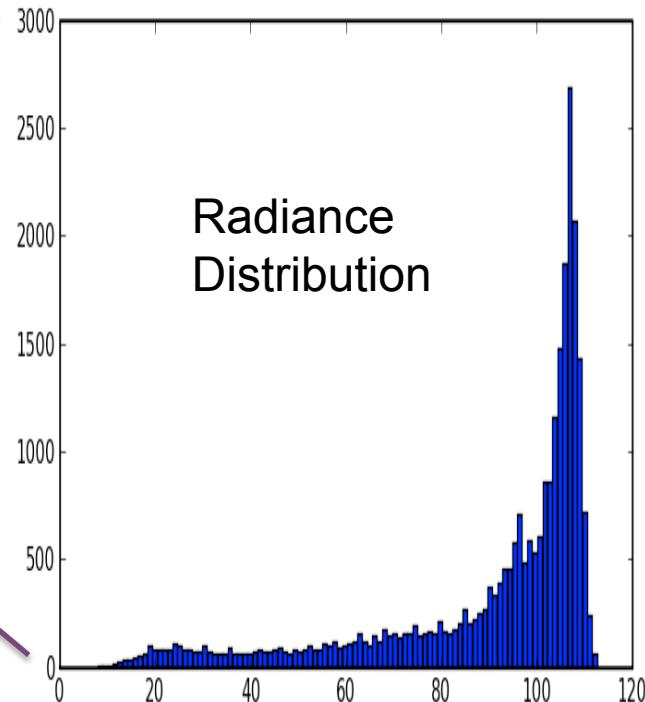
Average Radiance for wavenumber=911.24



Standard Deviation



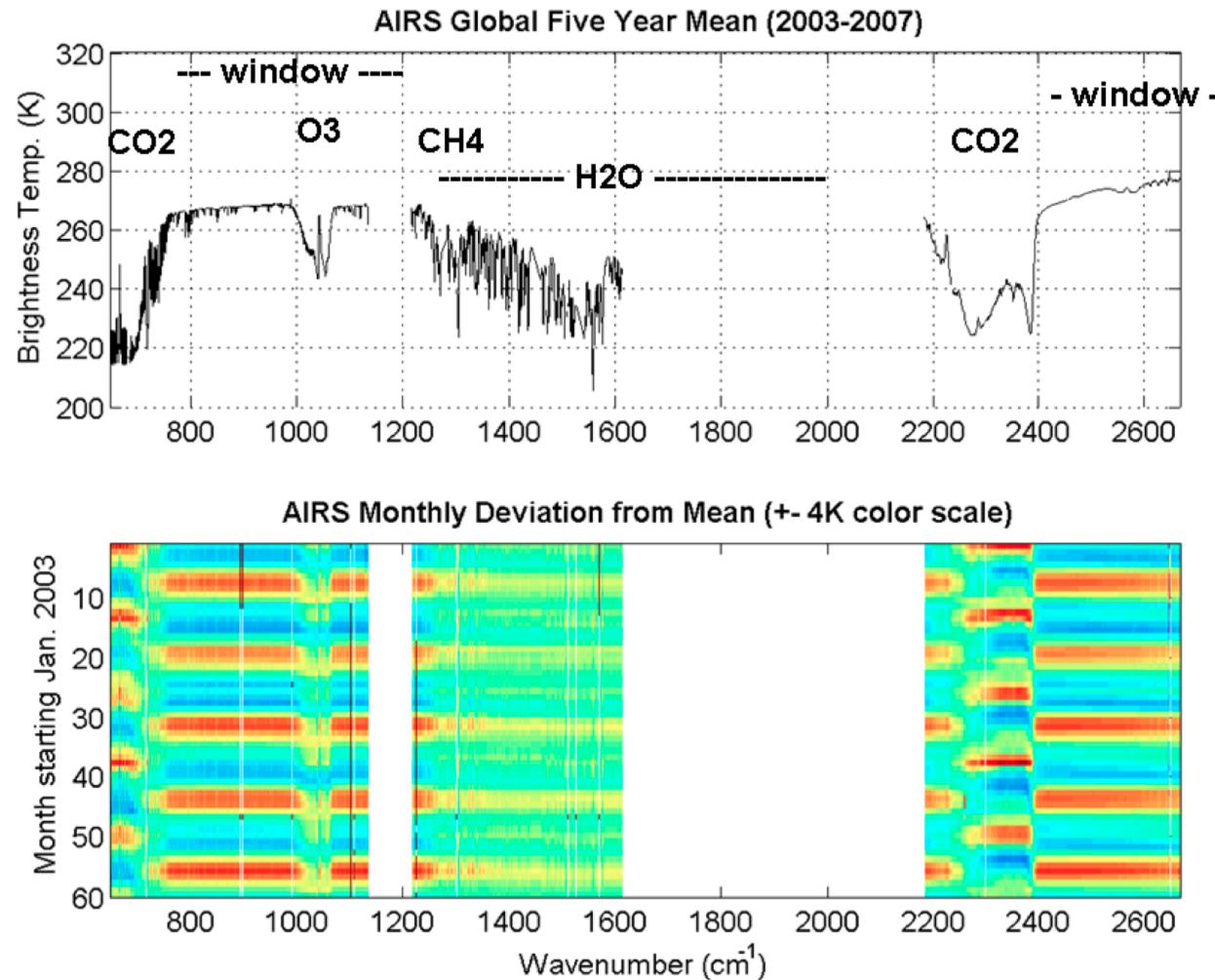
Radiance
Distribution



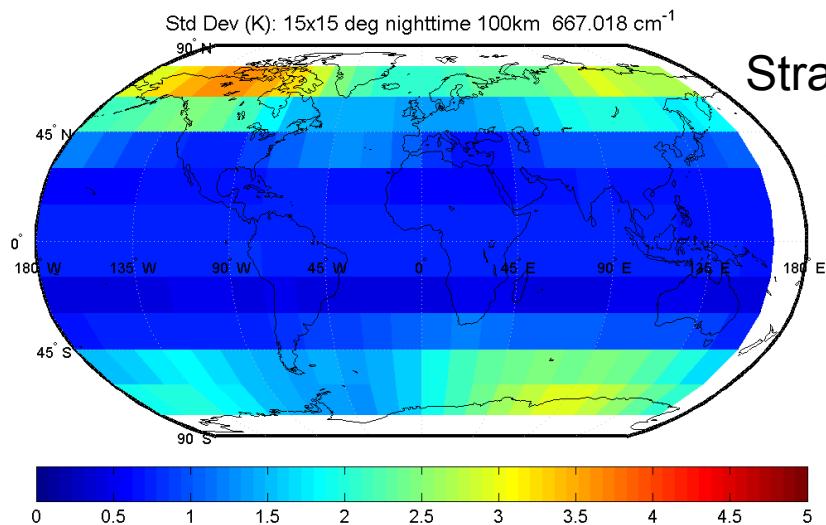
CLARREO IR Proxy Dataset derived from AIRS observations
(1 degree gridded monthly product)



CLARREO IR Proxy Dataset

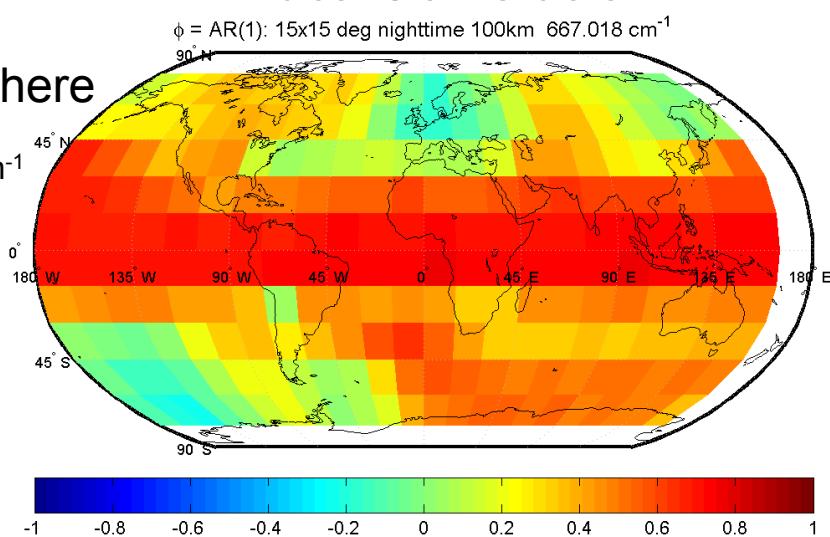


Standard Deviation

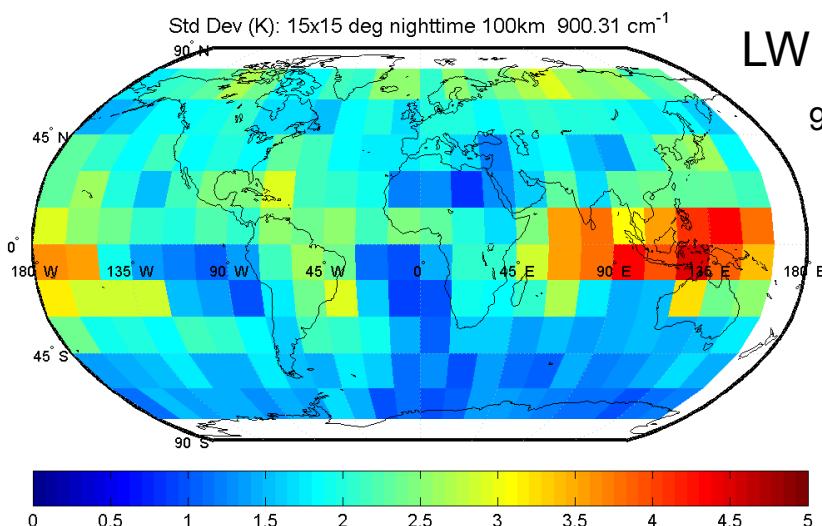


Auto-Correlation

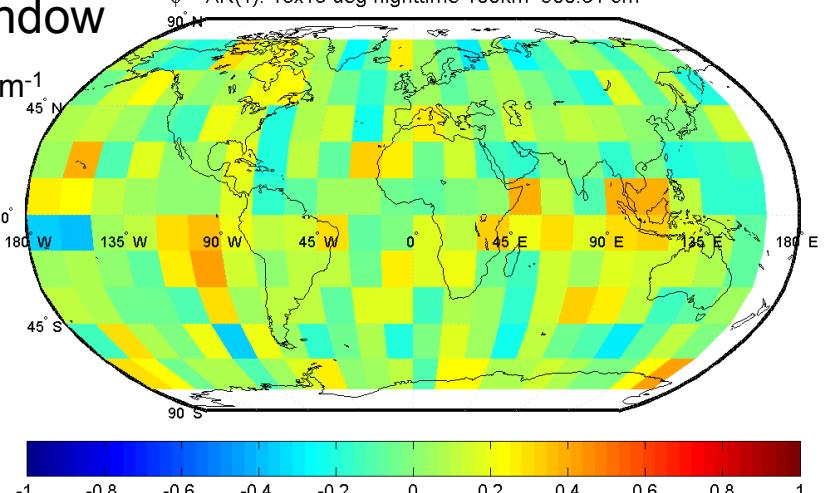
Stratosphere



LW Window



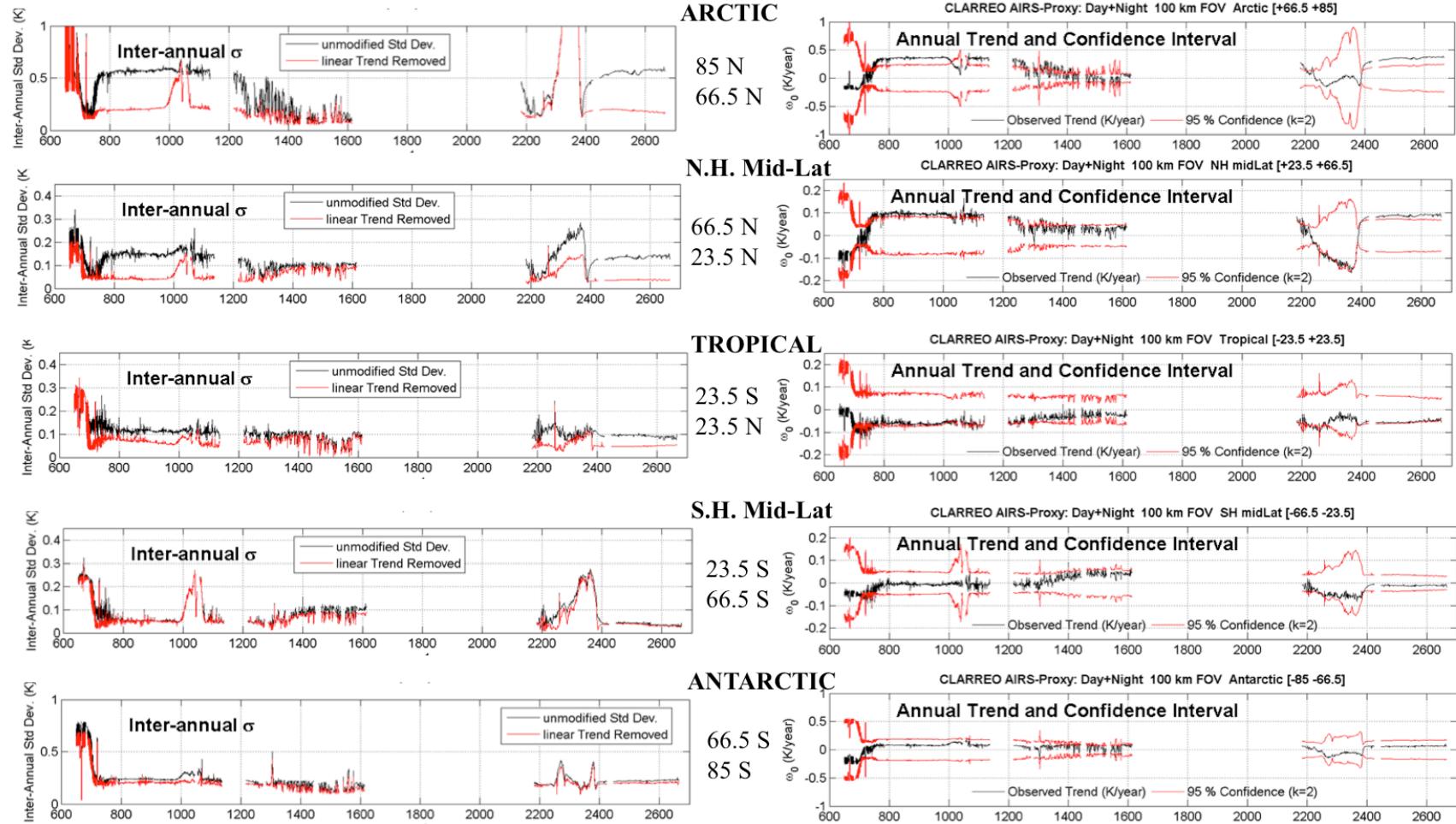
$\phi = \text{AR}(1)$: 15x15 deg nighttime 100km 900.31 cm^{-1}



Regional Monthly Variability (15°x15°)



CLARREO IR Proxy Dataset



CLARREO Proxy Dataset derived from AIRS observations was used to characterize natural variability from 3.5 to 15 microns.

AIRS-Proxy Inter-annual Variability Summary

Latitude Zone	Stratospheric Chs 4.3 μ m Std Dev. (K)	AIRS LW Window 11 μ m Std Dev (K)		
Global	0.1	0.02*	0.05	0.05*
Arctic	> 1.0	>1.0*	0.6	0.2*
NH Mid-Lat	0.25	0.15*	0.15	0.04*
Tropical	0.1	0.1*	0.11	0.06
SH Mid-Lat	0.25	0.25*	0.05	0.05*
Antarctic	0.2	0.2*	0.2	0.2*

100 km
FOV

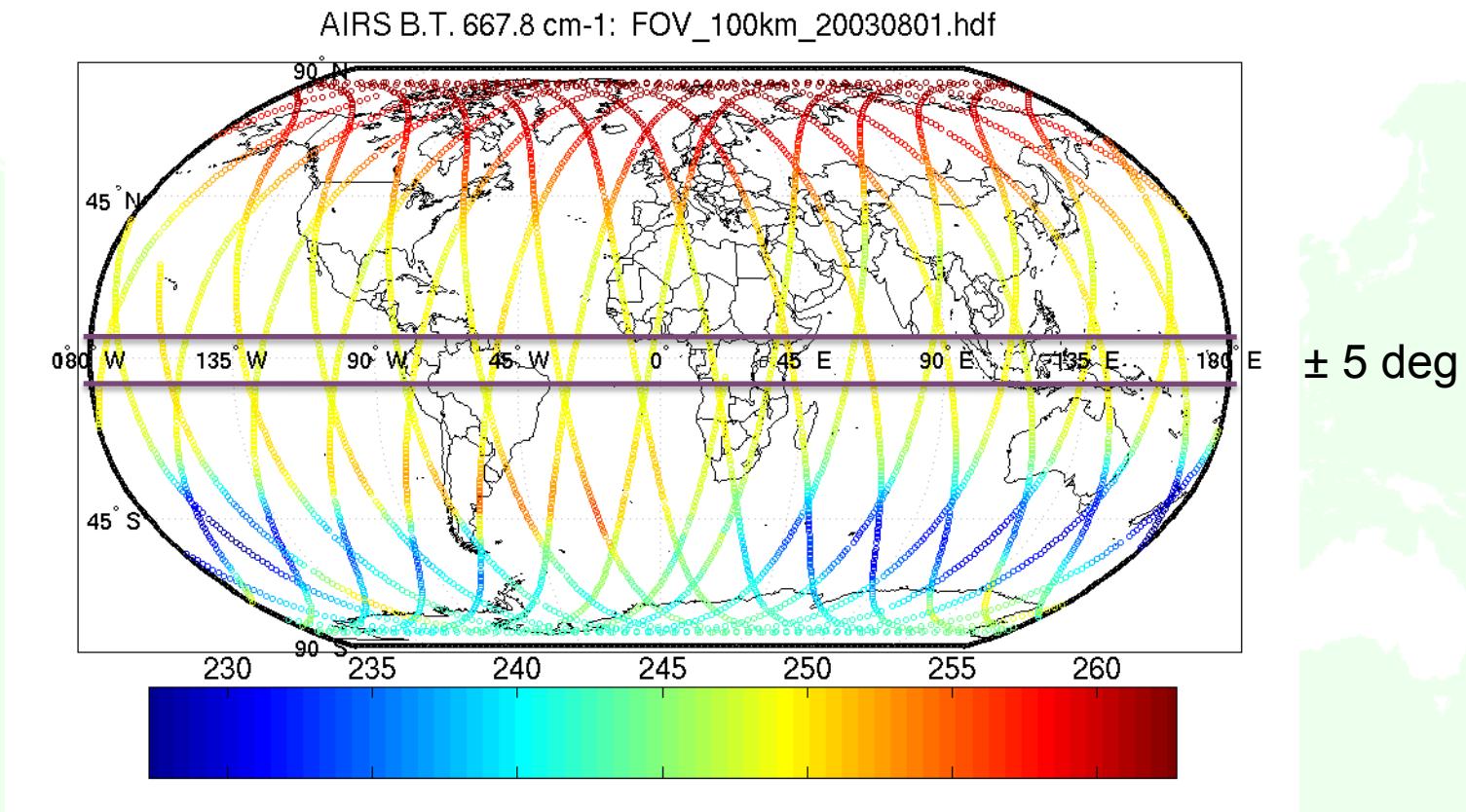


* Std Deviation after detrending

Slide 8

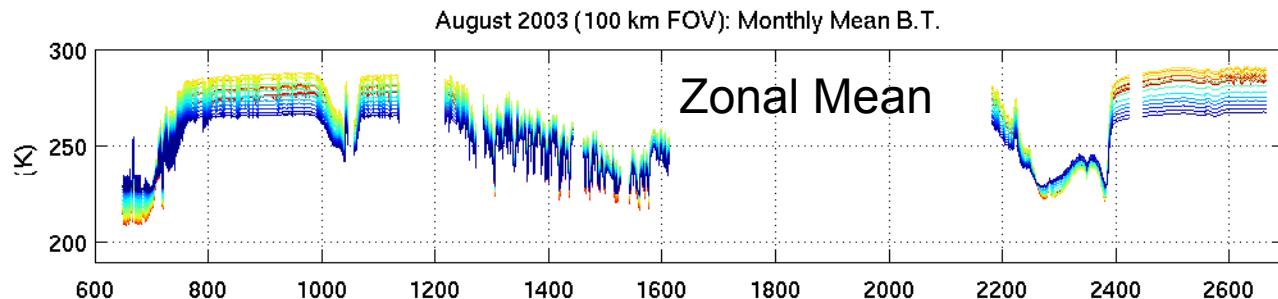


CLARREO IR Proxy Dataset

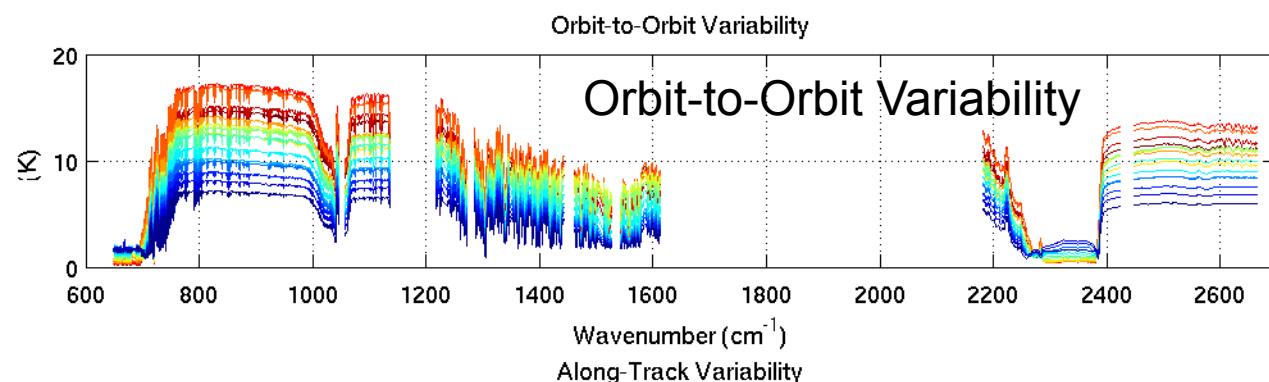


Used to evaluate the sensitivity of variability to CLARREO FOV diameter.

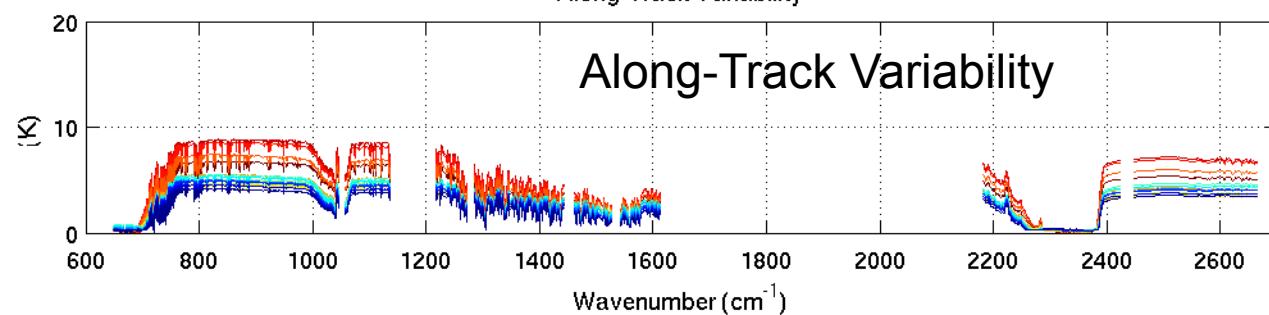
Define Measurement requirements (FOV dependence)



Northern Hemisphere
5 deg lat zones



Orbit-Orbit variability is larger than Along-track Variability



This explains why there is only weak sensitivity to FOV size.

Focus on Regional Water Vapor

Roman, Jacola A.; Knuteson, R.; Revercomb, H. and Tobin, D.
**Validation of Global Climate Model moisture trends for the
Coupled Model Intercomparison Project (CMIP) using GPS
Precipitable Water Vapor (PWV) observations in the US Great
Plains from 2000 to 2010.** In: Conference on Climate Variability
and Change, 23rd, Seattle, WA, 23-27 January 2011. Boston, MA,
American Meteorological Society (AMS), 2011.

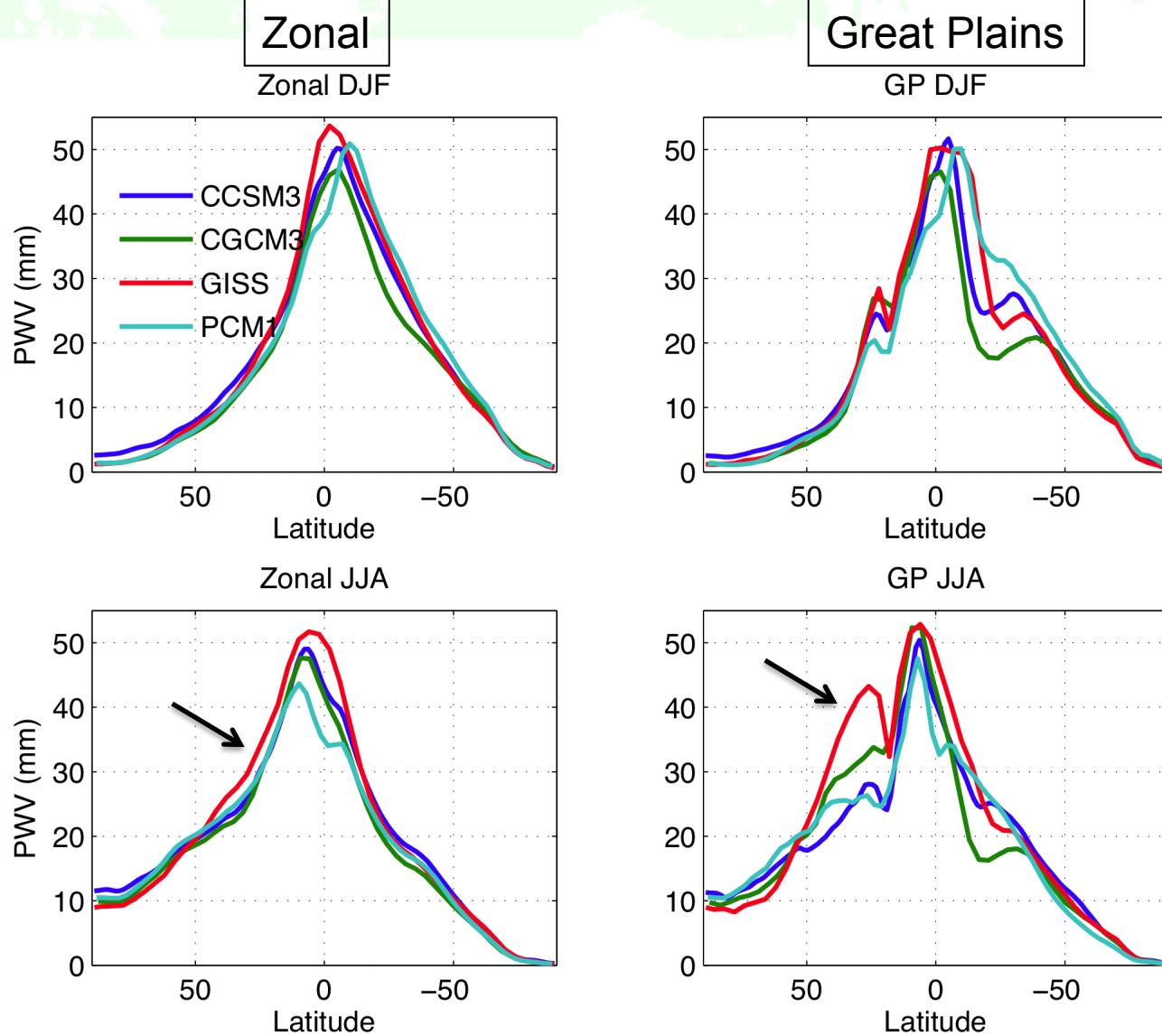
Undergraduate research project to look at regional
differences in climate model predictions and methods
to validate those models.

Focus on Regional Water Vapor

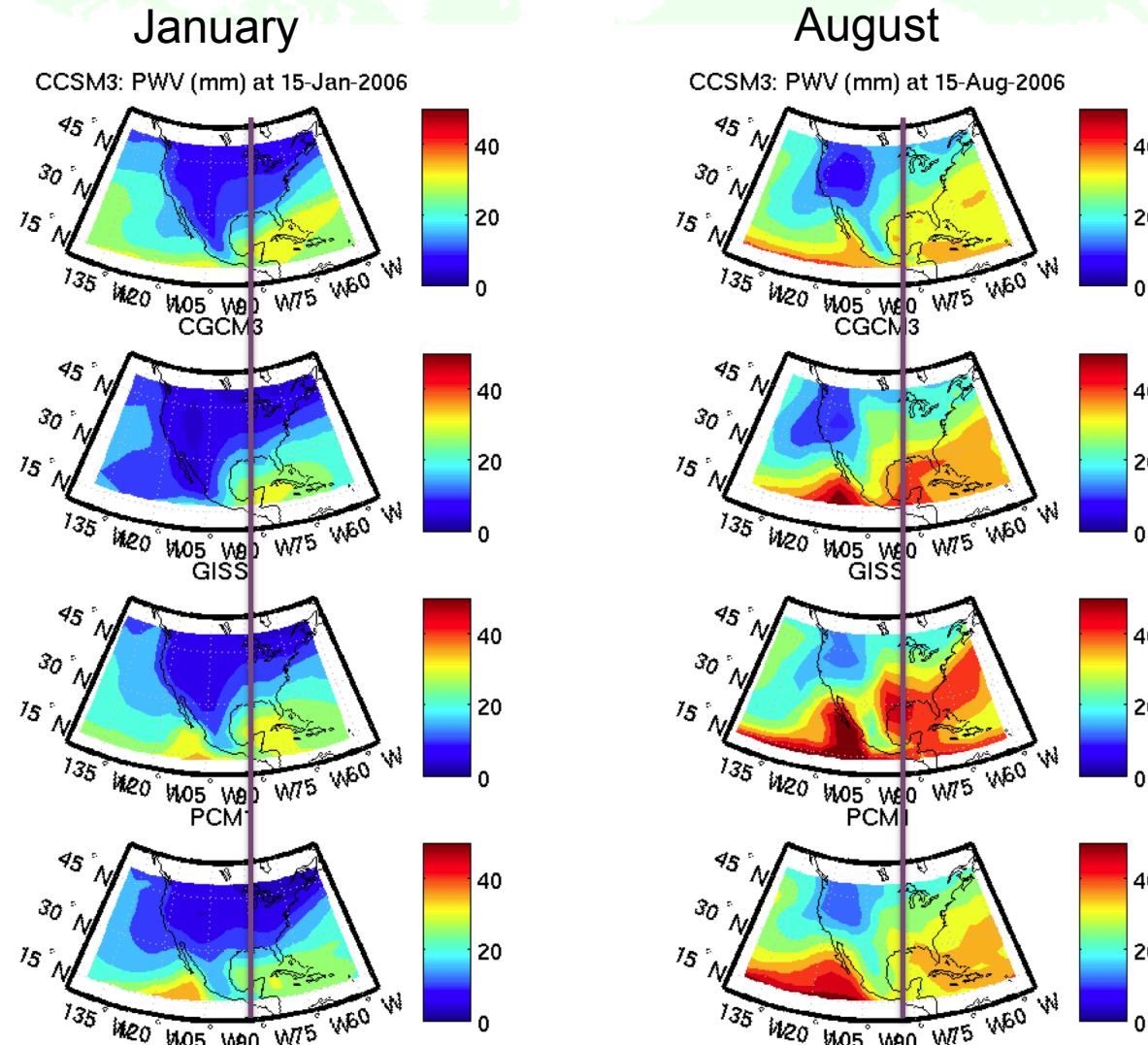
Total Column
Water Vapor

Winter

Summer



Focus on Regional Water Vapor



CCSM3

CGCM3

GISS

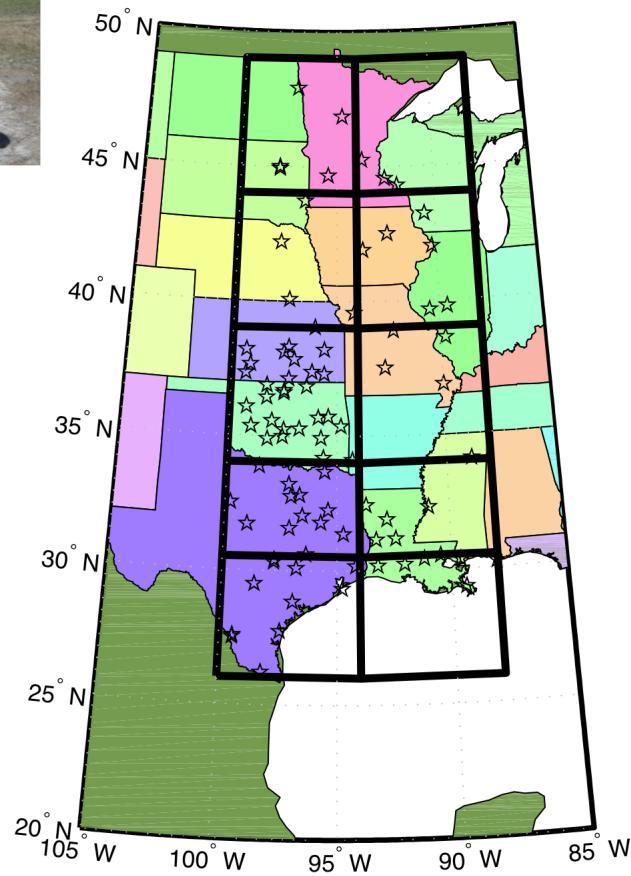
PCM1

Only the GISS model captures Summer time moisture flux from Gulf of Mexico

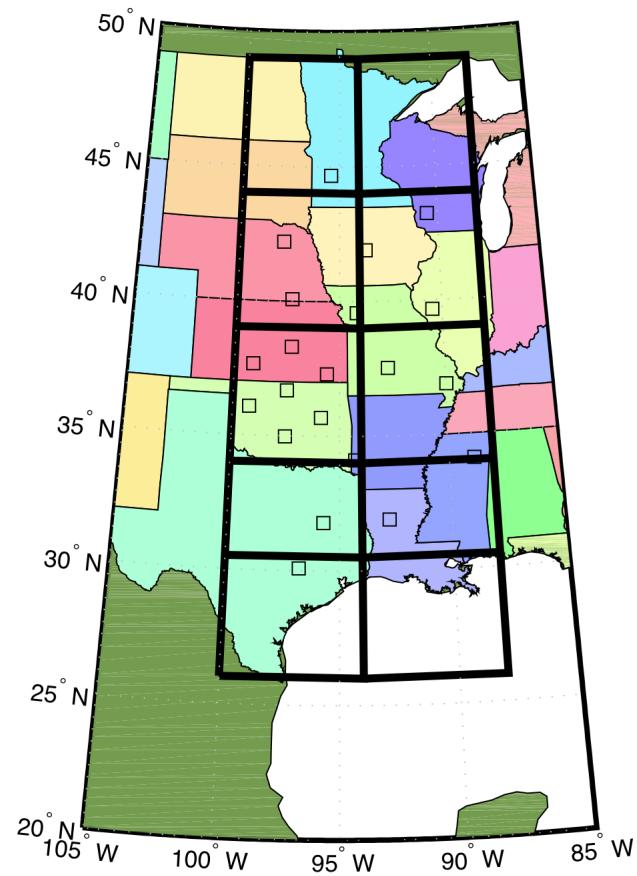
Focus on Water Vapor Validation



SuomiNet



Wind Profiler

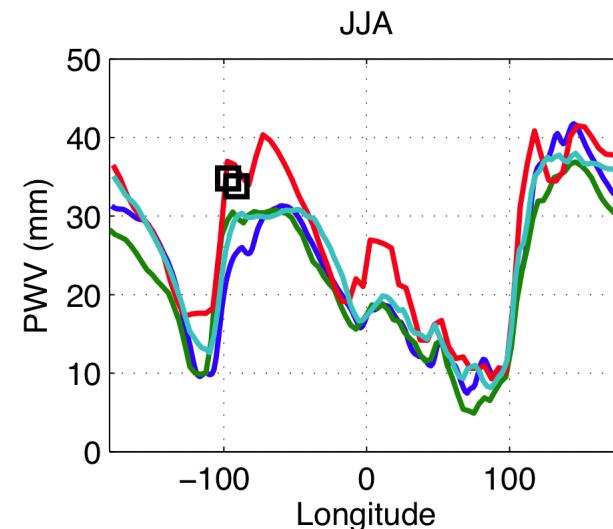
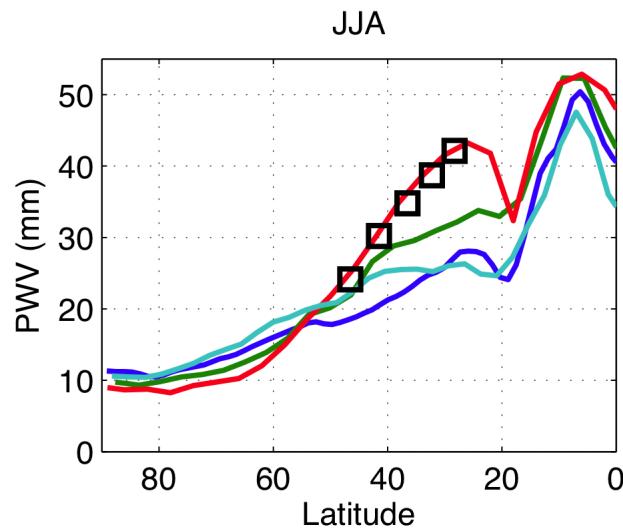
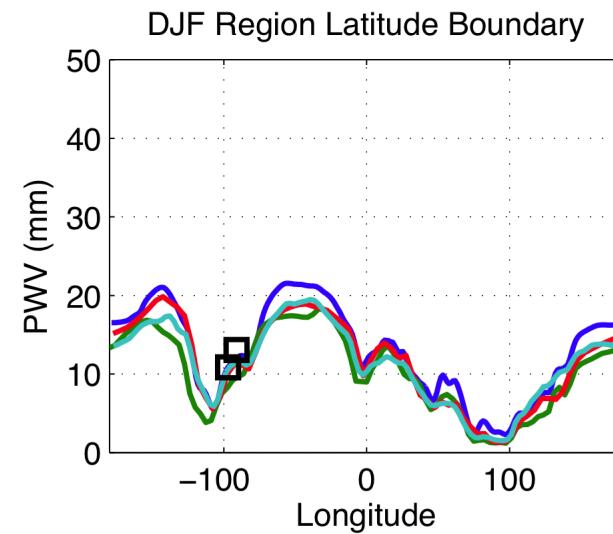
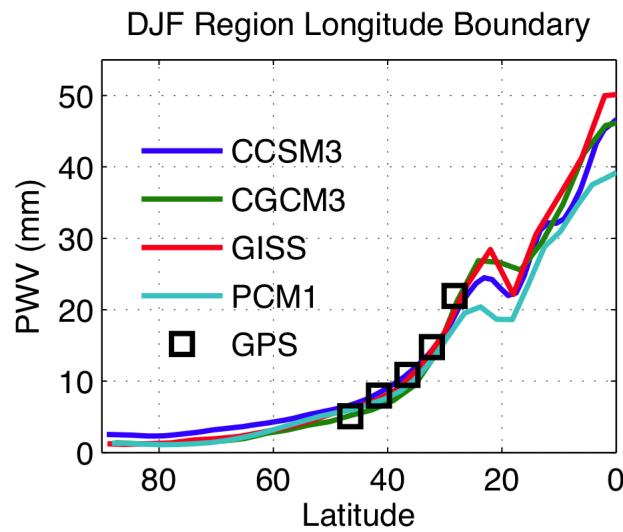


Ground-based networks of GPS receivers measure Total Column WV

Focus on Water Vapor Validation

Winter

Summer

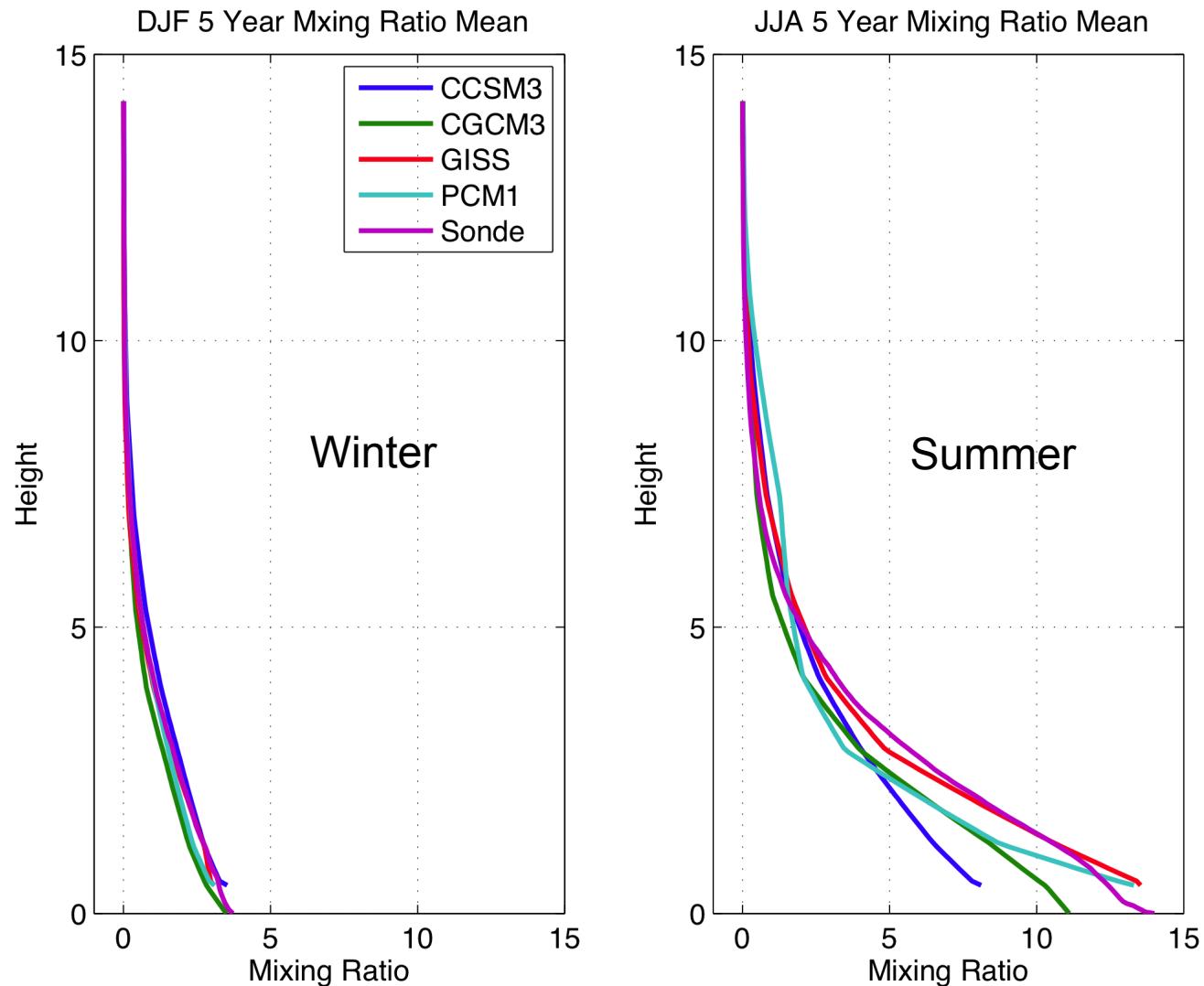


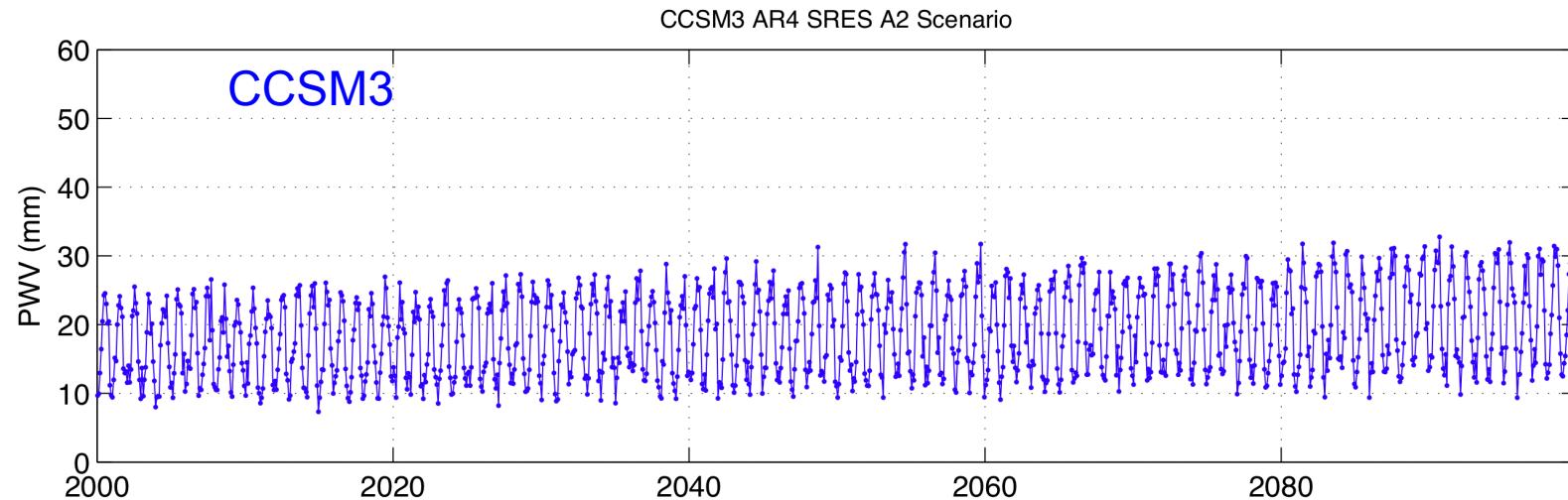
Latitude

Focus on Water Vapor Validation

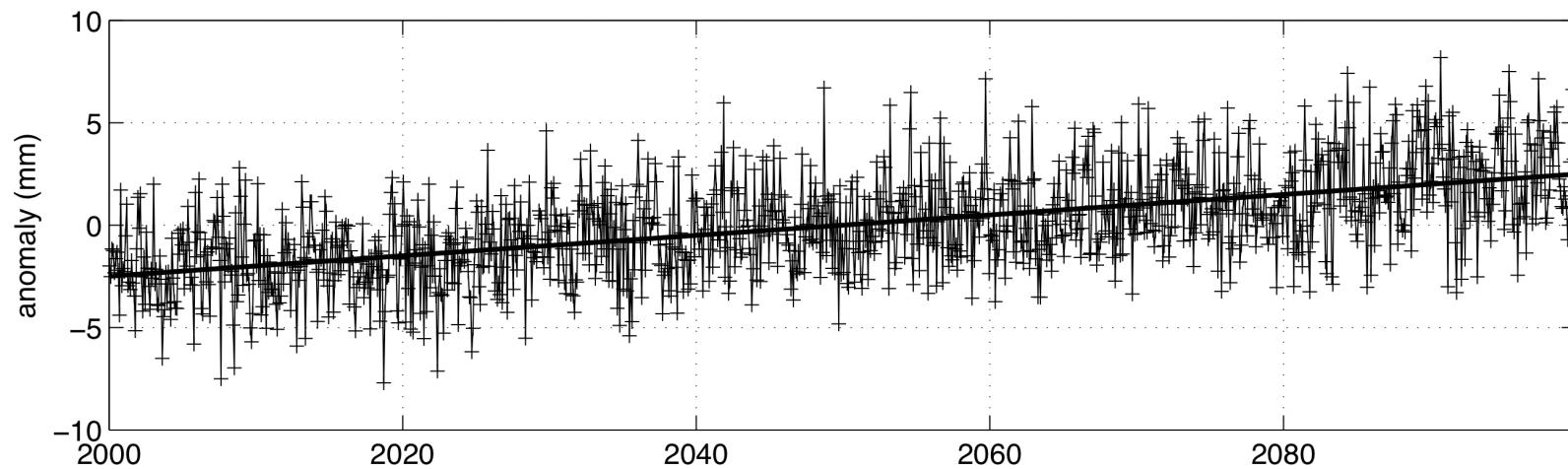
Water Vapor
Vertical Profile
Validation

Using
Radiosonde
data
from the
DOE ARM
SGP site





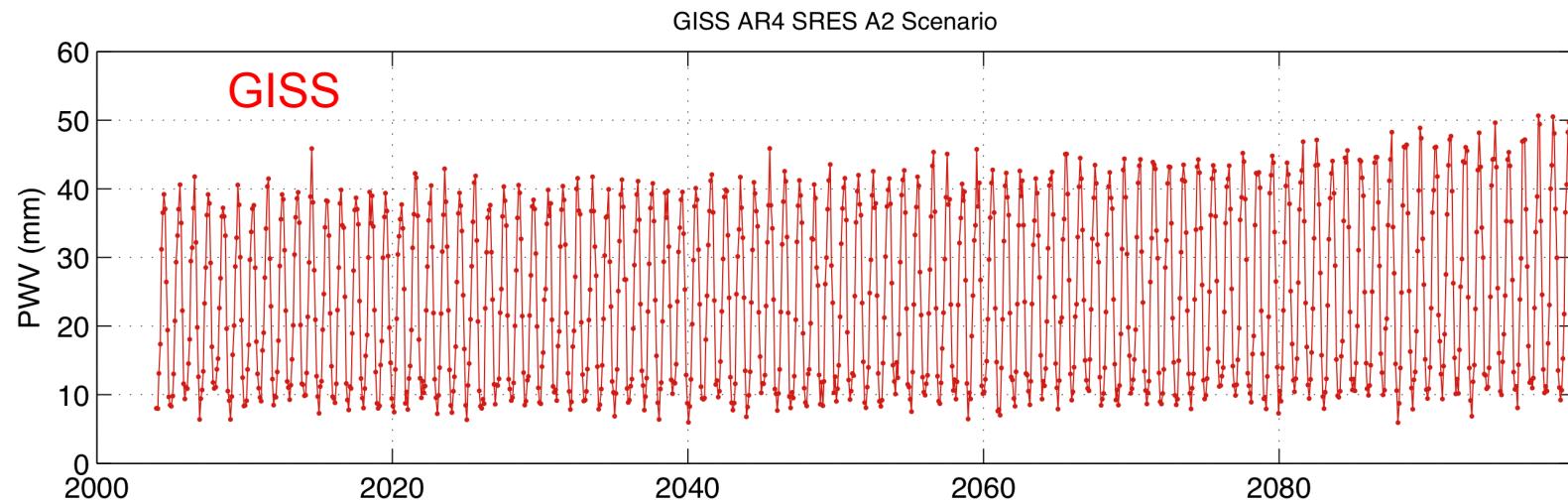
CCSM3 PWV Trend: 0.050 ± 0.008 mm/yr



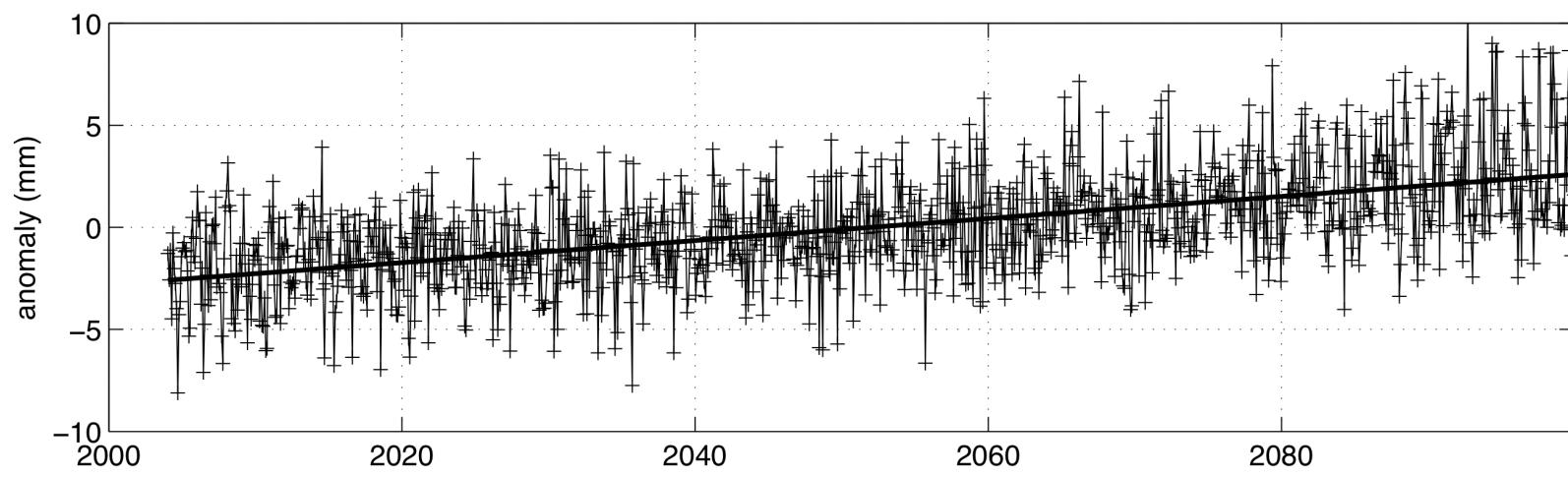
2000

CCSM3 has reduced seasonal amplitude for entire 100 year time period 2000-2100.

2100

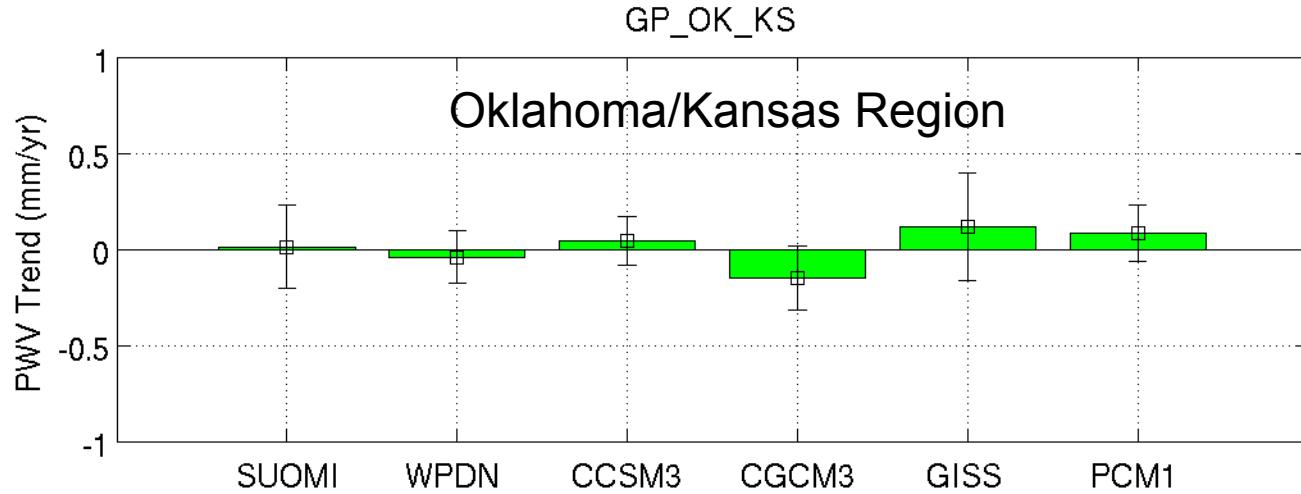


GISS PWV Trend: 0.054 ± 0.009 mm/yr



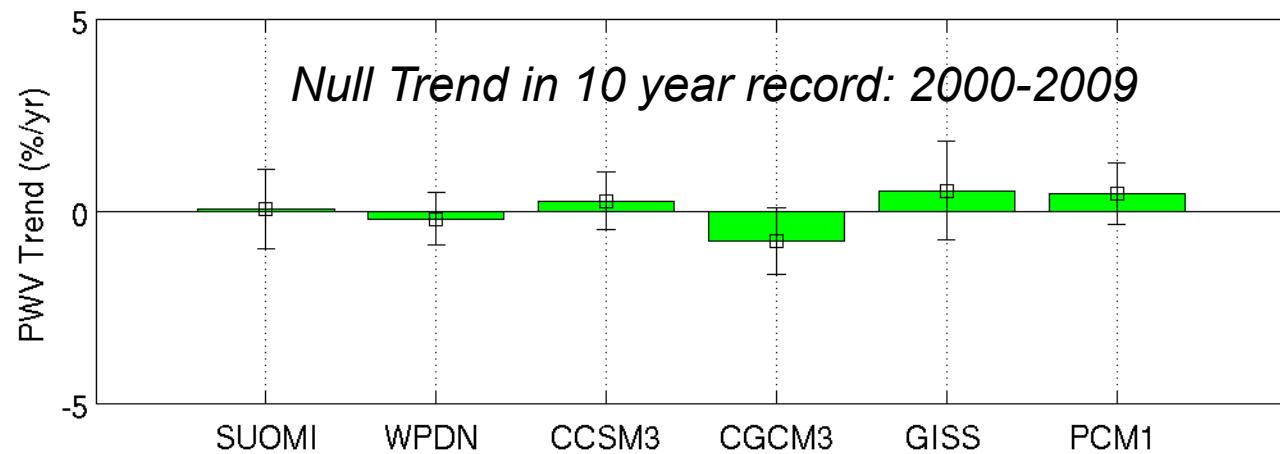
2000 *CCSM3 and GISS 100 yr PWV trends (in mm/yr)
are identical while Seasonal Amplitudes are very different!* 2100

Focus on Water Vapor



mm/yr Trend

2000 - 2009



% / yr Trend



Summary

- We propose to make use of the operational high spectral resolution cross-track sounders (NPP CrIS and METOP IASI) to further refine the measurement requirements for a future CLARREO mission.
- We will make use of CLARREO IR proxy datasets to determine variability on regional scales and develop methods to interrogate climate models using observations.